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18 separate items enclosed

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MEMORANDUM FOR PR (On-Site Contractor/In-House Publication)

FROM: PROI (TI) (STINFO) 29 February 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2000-037**
Campbell, D., Wadsworth, D., Wysong, I., Kaplan, C., "SUPREM DSMC: a New Scalable, Parallel, Reacting, Multidimensional Direct Simulation Monte Carlo Flow Code"

JANNAF Plume Technology Meeting **(Statement A)**
(Las Vegas, NV, 15-19 May 2000) (Deadline: 17 Apr 2000)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.
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_____

ROBERT C. CORLEY (Date)
Senior Scientist (Propulsion)
Propulsion Directorate

SUPREM DSMC: a New Scalable, Parallel, Reacting, Multidimensional Direct Simulation Monte Carlo Flow Code

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Ingrid Wysong
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Carolyn Kaplan
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An AFRL/NRL team has recently been selected to develop a scalable, parallel, reacting, multidimensional Direct Simulation Monte Carlo (DSMC) code for the DOD user community under the High Performance Computing Modernization Office (HPCMO) Common HPC Software Support Initiative (CHSSI). This paper will introduce the Exhaust Plume community to this three year development effort and present the overall goals, schedule, and present status of this new code.

The goal of this effort is to develop and transition to the DoD user community a modern, scalable DSMC code based on the integration of state-of-the-art collision models with advanced parallelization methods, gridding algorithms and data structures. While the paramount characteristics of the code will be robustness and ease of use, other goals include the following code capabilities:

- Parallel, scalable solution of CPU-intensive 3-D, unsteady, reacting flows
- Accurate representation of and resolution of highly nonequilibrium chemical and collisional processes by incorporating validated physical models
- Database of key reaction rates and molecular constants
- Automated grid adaptation and related capabilities to allow use by a broad range of nonexpert users
- Standardized and documented code operation and software-design methodology
- Easily extendable user interface and data structures to allow enduring use and continued code enhancement and customization

These code capabilities should provide a valuable tool for analysis of a wide range of exhaust plume problems, as well as find use in microelectro-mechanical device development, hypersonic flight and reentry vehicle analysis, and investigation of spacecraft environments.

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